

## CLAIMS

What is claimed is:

1. A system for generating a map of a surface, comprising:
  - a global position transmitter;
  - a vehicle, disposed over the surface;
  - an elevation measurement unit, secured to the vehicle;
  - a global positioning antenna, secured to the vehicle;
  - an attitude measurement unit, secured to the vehicle;
  - an imaging array, secured to the vehicle, comprising:
    - a housing;
    - an aperture, disposed in the housing, having an intersection area therein;
    - a first imaging sensor, coupled to the housing, having a first focal axis passing through the aperture within the intersection area; and
    - a second imaging sensor, coupled to the housing and offset from the first imaging sensor, having a second focal axis passing through the aperture and intersecting the first focal axis within the intersection area;
  - a computer, connected to the elevation measurement unit, the global positioning antenna, the attitude measurement unit and first and second imaging sensors; correlating at least a portion of the image data from the first and second imaging sensors to a portion of the surface based on input from one or more of: the elevation measurement unit, the global positioning antenna and the attitude measurement unit.

1 2. The system of claim 1 further comprising a third imaging sensor, coupled to the housing  
2 and offset from the first imaging sensor, having a second focal axis passing through the aperture  
3 and intersecting the first focal axis within the intersection area.

1 3. The system of claim 2 wherein the focal axis of the third imaging sensor lies in a  
2 common plane with the focal axes of the first and second imaging sensors.

1 4. The system of claim 2 wherein the focal axes of the first and second imaging  
2 sensors lie in a first common plane and the focal axis of the third imaging sensor lies in a plane  
3 orthogonal to the first common plane.

1 5. The system of claim 1 wherein the focal axis of the first imaging sensor is disposed  
2 vertically.

1 6. The system of claim 5 wherein the focal axis of the second imaging sensor is disposed in  
2 a first plane with, and at a first angle to, the focal axis of the first imaging sensor and a focal axis  
3 of a third imaging sensor is disposed opposite the second imaging sensor from the first imaging  
4 sensor in the first common plane and at a second angle having the same magnitude as the first  
5 angle.

1 7. The system of claim 6 further comprising fifth and sixth imaging sensors disposed on  
2 opposite sides of the first imaging sensor, having focal axes disposed in a second plane common  
3 with the focal axis of the first imaging sensor orthogonal to the first common plane and at third  
4 and fourth angles from the focal axis of the first imaging sensor having the same magnitude.

1  
1 8. A system for generating a map of a surface, comprising:  
2 a global position transmitter;  
3 a vehicle, disposed over the surface;  
4 an elevation measurement unit, secured to the vehicle;  
5 a global positioning antenna, secured to the vehicle;  
6 an attitude measurement unit, secured to the vehicle;  
7 a first imaging sensor, secured to the vehicle, having a focal axis disposed in the direction  
8 of the surface, generating an image comprising an array of pixels;  
9 a computer, connected to the elevation measurement unit, the global positioning antenna,  
10 the attitude measurement unit and the first imaging sensor; generating a calculated longitude and  
11 calculated latitude value for a coordinate corresponding to at least one pixel in the array based on  
12 input from one or more of: the elevation measurement unit, the global positioning antenna and  
13 the attitude measurement unit.

1 9. The system of claim 8 wherein the global position transmitter is satellite-based.

1 10. The system of claim 8 wherein the global position transmitter is ground-based.

1 11. The system of claim 8 wherein the elevation measurement is a LIDAR apparatus.

1 12. The system of claim 8 wherein the attitude measurement unit is a gyroscope.

1 13. The system of claim 8 wherein the focal axis of the first imaging sensor is vertical and  
2 passes through an aperture, and wherein the system further comprises:

3 a second imaging sensor, coupled to the vehicle and offset from the first imaging  
4 sensor, having a second focal axis passing through the aperture and intersecting the first  
5 focal axis within an intersection area, and

6 a third imaging sensor, coupled to the vehicle and offset from the first imaging  
7 sensor opposite the second imaging sensor, having a third focal axis passing through the  
8 aperture and intersecting the first focal axis within the intersection area.

1 14. The system of claim 13 wherein the vehicle has a direction vector, and wherein the focal  
2 axis of the second imaging sensor lies in a plane orthogonal to the direction vector of the vehicle.

1 15. A system for generating a map of a surface, comprising:  
2 a global position transmitter;  
3 a vehicle, disposed over the surface;  
4 an elevation measurement unit, secured to the vehicle;  
5 a global positioning antenna, secured to the vehicle;  
6 an attitude measurement unit, secured to the vehicle;  
7 an imaging array, secured to the vehicle, comprising:  
8 a housing;  
9 an aperture, disposed in the housing, having an intersection area therein;  
10 a first imaging sensor, coupled to the housing, having a focal axis passing through  
11 the aperture within the intersection area, generating a first array of pixels; and  
12 a second imaging sensor, coupled to the housing and offset from the first imaging  
13 sensor, having a second focal axis passing through the aperture and intersecting the first  
14 focal axis within the intersection area, generating a second array of pixels;  
15 a computer, connected to one or more of: the elevation measurement unit, the global  
16 positioning antenna, the attitude measurement unit, the first imaging sensor and the second  
17 imaging sensor; calculating the true longitude and true latitude of at least one point on the  
18 surface corresponding to at least one pixel in the array based on the input from one or more of:  
19 the elevation measurement unit, the global positioning antenna and the attitude measurement  
20 unit.

1 16. The system of claim 15 wherein further comprising a third imaging sensor, coupled to the  
2 housing and offset from the first imaging sensor, having a second focal axis passing through the  
3 aperture and intersecting the first focal axis within the intersection area.

1 17. The system of claim 16 wherein the focal axis of the third imaging sensor lies in a  
2 common plane with the focal axes of the first and second imaging sensors.

1 18. The system of claim 16 wherein the focal axes of the first and second imaging sensors lie  
2 in a first common plane and the focal axis of the third imaging sensor lies in a plane orthogonal  
3 to the first common plane.

1 19. The system of claim 16 wherein the focal axis of the third imaging sensor lies in a first  
2 common plane with the focal axes of the first and second imaging sensors and wherein the  
3 system further comprises a fourth imaging sensor having a focal axis lying in a plane orthogonal  
4 to the first common plane.

1 20. The system of claim 16 wherein the focal axis of the third imaging sensor lies in a first  
2 common plane with the focal axes of the first and second imaging sensors and the system further  
3 comprises fourth and fifth imaging sensors having focal axes lying in the first common plane and  
4 intersecting the focal axis of the first imaging sensor within the intersection area.